

4. PRODUCTION, IMPORT, USE, AND DISPOSAL

4.1 PRODUCTION

U.S. manufacturers have an estimated annual production capacity of 13.1 billion pounds of mixed xylene (SRI 1994). This figure is an estimate based on maximum plant production volumes.

Table 4-1 lists producers of mixed xylene and their estimated annual capacities. In 1990 and 1991, U.S. production of xylene totaled 6.2 billion pounds and 6.1 billion pounds, respectively (Reisch 1992). These figures represent the total amount of mixed xylene actually produced by U.S. manufacturers based on data from trade associations and industry sources. The nonconfidential U.S. aggregate production volume reported by EPA for 1990, based on industry submissions, was approximately 12.1 billion pounds for mixed xylene (CUS 1993).

Table 4-2 summarizes the number of facilities in each state that manufactured or processed mixed xylene in 1990, the ranges of maximum amounts on site, if reported, and the activities and uses as reported in the Toxics Release Inventory (TRI) (TRI92 1994). The data listed in this table should be used with caution since only certain types of facilities are required to report. This is not an exhaustive list.

According to commercial estimates, over 943 million pounds of *o*-xylene and over 5.2 billion pounds of *p*-xylene were produced in the United States in 1990 (Reisch 1992; USITC 1991). However, U.S. nonconfidential aggregate production volumes for 1990 reported in the TRI, based on industry submissions, were 928.9 million pounds of *o*-xylene, 8.3 billion pounds of *p*-xylene, and 168.6 million pounds of *m*-xylene (CUS 1993). Xylene production volumes reported in the TRI may be higher than commercial estimates because reporting by industry is mandatory, whereas commercial estimates may not include all xylene manufacturers. In 1991, U.S. production of *p*-xylene totaled 5.4 billion pounds (Reisch 1992).

Tables 4-3, 4-4, and 4-5 list the facilities that manufacture or process *m*-xylene, *o*-xylene, and *p*-xylene, respectively, with their corresponding location, range of maximum amounts on site, and activities and uses. This information is based on the release data reported to the TRI for

TABLE 4-1. Producers of Xylene and Estimated Annual Capacities^a

Producers	Location(s)	Annual capacity (millions of pounds)			
		Mixed xylene	<i>m</i> -Xylene	<i>o</i> -Xylene	<i>p</i> -Xylene
Amoco Corporation	Decatur, Alabama		—	—	NR
	Texas City, Texas	1,490	NR	—	NR
	Whiting, Indiana	1,399	—	—	—
Ashland Oil, Inc.	Catlettsburg, Kentucky	183	—	—	—
BP America, Inc.	Alliance, Louisiana	432	—	—	—
Chevron Corporation	Pascagoula, Mississippi	651	—	—	NR
CITGO Petroleum Corporation	Corpus Christi, Texas	240	—	—	—
The Coastal Corporation	Corpus Christi, Texas	168	—	—	—
Exxon Corporation	Baytown, Texas	1,870	—	NR	NR
Fina Inc.	Port Arthur, Texas	693	—	—	—
Hess Corporation	St. Croix, Virgin Islands	1,067	—	—	—
Koch Industries, Inc.	Corpus Christi, Texas	1,541	—	NR	NR
Lyondell Petrochemical Co.	Houston, Texas	745	—	NR	NR
Mobil Corporation	Chalmette, Louisiana	218	—	NR	NR
Marathon Oil Company	Texas City, Texas	79	—	—	—
Occidental Petroleum Corp.	Corpus Christi, Texas	145	—	—	—
Phibro Energy USA, Inc.	Houston, Texas	100	—	—	—
Phillips Petroleum Company	Sweeny, Texas	268	—	—	—
	Guayama, Puerto Rico	725	—	NR	NR
Shell Oil Company	Deer Park, Texas	397 ^b	—	—	—
Southwestern Refining Co., Inc.	Corpus Christi, Texas	216	—	—	—
Sun Company, Inc.	Marcus Hook, Pennsylvania	187	—	—	—
	Toledo, Ohio	375	—	—	—
The UNO-VEN Company	Lemont, Illinois	73	—	—	—
TOTALS		13,162	NR	NR	NR

^a Derived from SRI 1994^b Plant is on standby

— = not produced; NR = The xylene was produced but the amount was not reported

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Table 4-2. Facilities That Manufacture or Process Mixed Xylene

State ^a	Number of facilities	Range of maximum amounts on site in thousands of pounds ^b	Activities and uses ^c
AK	2	1000-10000	1, 3, 4, 8
AL	93	0-500000	1, 2, 3, 4, 6, 8, 9, 10, 11, 12, 13
AR	69	0-10000	1, 2, 4, 7, 8, 9, 11, 12, 13
AZ	11	1-10000	2, 3, 6, 8, 10, 11, 12, 13
CA	163	0-500000	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13
CO	14	0-10000	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13
CT	29	0-1000	2, 3, 4, 7, 8, 9, 10, 11, 12, 13
DE	5	10-100000	1, 6, 7, 8, 11, 12, 13
FL	50	0-10000	2, 4, 8, 9, 10, 11, 12, 13
GA	95	0-100000	1, 3, 6, 7, 8, 9, 10, 11, 12, 13
IA	88	0-10000	1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 13
ID	1	10-100	3, 8
IL	213	0-500000	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,
IN	215	0-100000	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,
KS	53	0-50000	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,
KY	69	0-50000	1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
LA	65	0-.9E+6	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,
MA	50	0-1000	2, 3, 4, 8, 9, 10, 11, 12, 13
MD	23	0-1000	7, 8, 9, 10, 11, 12, 13
ME	14	0-100	11, 12, 13
MI	160	0-50000	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,
MN	76	0-100000	1, 2, 3, 4, 6, 8, 9, 10, 11, 12, 13
MO	109	0-10000	2, 3, 8, 9, 10, 11, 12, 13
MS	67	0-1000	1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 13
MT	6	0-500000	1, 2, 3, 4, 6, 7, 8, 9, 13
NC	109	0-1000	2, 3, 7, 8, 9, 10, 11, 12, 13
ND	8	0-50000	1, 2, 3, 7, 9, 10, 11, 12, 13
NE	31	0-100	7, 8, 9, 11, 12, 13
NH	9	0-100	2, 3, 8, 9, 11, 12, 13
NJ	109	0-500000	1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 13
NM	7	0-10000	1, 3, 4, 5, 6, 8, 13
NV	5	1-100	8, 9, 11, 13
NY	110	0-1000	1, 2, 5, 6, 8, 9, 10, 11, 12, 13
OH	234	0-500000	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,
OK	40	0-500000	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,
OR	26	1-10000	8, 9, 10, 11, 12, 13
PA	194	0-50000	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,
PR	15	1-500000	1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 13
RI	9	0-1000	8, 10, 12, 13
SC	63	0-500000	2, 3, 7, 8, 9, 10, 11, 12, 13

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Table 4-2. Facilities That Manufacture or Process Mixed Xylene (continued)

State ^a	Number of facilities	Range of maximum amounts on site in thousands of pounds ^b	Activities and uses ^c
SD	17	0-100	8, 9, 11, 12, 13
TN	111	0-10000	1, 2, 3, 5, 8, 9, 10, 11, 12, 13
TX	225	0-.9E+6	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,
UT	21	0-10000	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13
VA	94	0-10000	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,
VI	1	50000-100000	1, 2, 3, 4, 7
VT	2	1-100	8, 12
WA	38	0-100000	1, 2, 3, 4, 6, 7, 8, 10, 11, 12, 13
WI	120	0-50000	1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 13
WV	30	0-10000	1, 5, 6, 7, 8, 9, 10, 11, 12, 13
WY	6	1-50000	1, 2, 3, 4, 5, 6, 7, 8, 10, 11

Source: TRI92 1994

^a Post office state abbreviations used^b Data in TRI are maximum amounts on site at each facility.^c Activities/Uses:

- | | |
|-------------------------------|----------------------------------|
| 1. Produce | 8. As a formulation component |
| 2. Import | 9. As a product component |
| 3. For on-site use/processing | 10. For repackaging |
| 4. For sale/distribution | 11. As a chemical processing aid |
| 5. As a byproduct | 12. As a manufacturing aid |
| 6. As an impurity | 13. Ancillary or other uses |
| 7. As a reactant | |

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Table 4-3. Facilities That Manufacture or Process m-Xylene

State ^a	Number of facilities	Range of maximum amounts on site in thousands of pounds ^b	Activities and uses ^c
AL	1	10000-50000	7
AR	3	0-100	8, 9, 10, 12
CA	9	0-50000	1, 3, 4, 5, 6, 7, 8, 9, 10, 13
GA	1	10-100	8
HI	2	1000-10000	1, 2, 6, 8
IA	1	10-100	13
IL	3	1-50000	2, 3, 7, 12
IN	1	0-1	9
KS	1	10-100	7, 13
KY	2	10-100	1, 4, 5, 11, 12
LA	2	10-50000	1, 3, 4, 6, 7
MN	1	1-10	8
MO	3	1-100	8, 13
MS	4	1-50000	1, 3, 4, 7, 8, 11
NC	1	100-1000	7
NJ	1	1-10	8, 12
NY	1	1-10	10, 11
OH	1	1-10	11
OR	1	10-100	8
PA	2	100-50000	1, 3, 8, 10
PR	7	1-100	1, 2, 3, 5, 8, 13
TN	3	1-50000	1, 3, 8, 12, 13
TX	15	1-100000	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13
UT	2	100-10000	1, 4, 11
WI	1	1-10	6, 7, 11
WV	1	10-100	1, 7, 8

Source: TRI92 1994

^a Post office state abbreviations used^b Data in TRI are maximum amounts on site at each facility.^c Activities/Uses:

- | | |
|-------------------------------|----------------------------------|
| 1. Produce | 8. As a formulation component |
| 2. Import | 9. As a product component |
| 3. For on-site use/processing | 10. For repackaging |
| 4. For sale/distribution | 11. As a chemical processing aid |
| 5. As a byproduct | 12. As a manufacturing aid |
| 6. As an impurity | 13. Ancillary or other uses |
| 7. As a reactant | |

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Table 4-4. Facilities That Manufacture or Process o-Xylene

State ^a	Number of facilities	Range of maximum amounts on site in thousands of pounds ^b	Activities and uses ^c
AL	3	10-50000	7, 11
AR	2	1-1000	8, 10
CA	11	0-50000	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13
CT	1	100-1000	11
GA	2	1-1000	8, 11, 13
HI	2	1000-10000	1, 2, 6, 8
IL	3	100-50000	2, 3, 7, 11
IN	1	10-100	11, 13
KS	2	100-10000	7, 13
KY	1	10-100	11
LA	4	100-50000	1, 3, 4, 6, 7, 11, 13
MI	1	10-100	11
MO	4	0-50000	7, 8, 13
MS	2	100-50000	1, 3, 4, 8
NC	3	0-100	8, 11
NJ	2	10-1000	7, 13
NY	2	1-100	10, 11, 12, 13
OH	3	0-10	8, 12, 13
PA	3	10-10000	1, 3, 8, 10, 11
PR	4	0-100	1, 2, 3, 4, 8, 11, 13
RI	1	10-100	8
SC	2	100-10000	7, 11
TN	4	0-50000	1, 3, 8, 11, 13
TX	18	1-50000	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 13
UT	1	1000-10000	1, 4
WI	1	100-1000	11, 13
WV	1	1-10	1, 7, 8

Source: TRI92 1994

^a Post office state abbreviations used^b Data in TRI are maximum amounts on site at each facility.^c Activities/Uses:

- | | |
|-------------------------------|----------------------------------|
| 1. Produce | 8. As a formulation component |
| 2. Import | 9. As a product component |
| 3. For on-site use/processing | 10. For repackaging |
| 4. For sale/distribution | 11. As a chemical processing aid |
| 5. As a byproduct | 12. As a manufacturing aid |
| 6. As an impurity | 13. Ancillary or other uses |
| 7. As a reactant | |

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Table 4-5. Facilities That Manufacture or Process p-Xylene

State ^a	Number of facilities	Range of maximum amounts on site in thousands of pounds ^b	Activities and uses ^c
AL	1	50000-100000	1, 3, 4, 7
CA	9	0-50000	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13
HI	2	1000-10000	1, 2, 6, 8
LA	1	10000-50000	1, 3, 4, 7
MA	3	1-100	8, 10, 11
MO	1	1-10	13
MS	1	50000-100000	1, 4
NC	2	0-100000	2, 3, 7
NJ	1	10-100	8
NY	1	100-1000	8, 10, 11
PA	2	100-10000	1, 3, 8, 10
PR	1	1000000-0	1, 4
SC	2	10000-500000	7
TN	3	0-50000	1, 3, 7, 8, 11, 13
TX	12	10-100000	1, 2, 3, 4, 6, 7, 8, 9, 10, 12
UT	1	1000-10000	1, 4
VI	1	50000-100000	1, 2, 3, 4, 7
WV	1	1-10	1, 7, 8

Source: TRI92 1994

^a Post office state abbreviations used^b Data in TRI are maximum amounts on site at each facility.^c Activities/Uses:

- | | |
|-------------------------------|----------------------------------|
| 1. Produce | 8. As a formulation component |
| 2. Import | 9. As a product component |
| 3. For on-site use/processing | 10. For repackaging |
| 4. For sale/distribution | 11. As a chemical processing aid |
| 5. As a byproduct | 12. As a manufacturing aid |
| 6. As an impurity | 13. Ancillary or other uses |
| 7. As a reactant | |

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1992 (TRI92 1994). The data listed in these tables should be used with caution since only certain types of facilities are required to report and the actual figures may be higher.

Mixed xylene consists of a mixture of ethylbenzene and the *m*-, *o*-, and *p*-isomers of xylene; *m*-xylene predominates. In addition to ethylbenzene, mixed xylene may contain nonxylene hydrocarbons, such as benzene, toluene, trimethylbenzene, phenol, thiophene, and pyridine; the combined volume of these nonxylene hydrocarbons is only a fraction of a percentage point of the composition of mixed xylene (Gerarde 1960; Riihimaki and Hanninen 1987; Sandmeyer 1981). Current formulations of mixed xylene are relatively free (less than 0.001%) of benzene contamination (Gosselin et al. 1984; Riihimaki and Hanninen 1987). The exact composition of mixed xylene depends on the manufacturing method used. Currently, nearly all mixed xylene is produced as a catalytic reformat of petroleum and consist of approximately 44% *m*-xylene, 20% *o*-xylene, 20% *p*-xylene, and 15% ethylbenzene (HSDB 1992; NIOSH 1975). Mixed xylene may also be manufactured from coal tar, yielding a mixture of approximately 45-70% *m*-xylene, 23% *p*-xylene, 10-15% *o*-xylene, and 6-10% ethylbenzene (HSDB 1992). Other production processes include gasoline pyrolysis and disproportionation of toluene, both of which produce a mixture free of ethylbenzene, and recovery from coke-oven light oil (HSDB 1992; NIOSH 1975; Ransley 1984).

The xylene isomers are produced from mixed xylene. *m*-Xylene is obtained from mixed xylene via crystallization to remove *p*-xylene and fractionation to remove *o*-xylene and ethylbenzene, or via complexing with hydrofluoric acid and boron trifluoride (HSDB 1992). *o*-Xylene is isolated from mixed xylene via distillation but can also be produced by the isomerization of *m*-xylene (HSDB 1992). *p*-Xylene is derived from mixed xylene by crystallization, solvent extraction, or adsorption (Hawley 1981; HSDB 1992).

4.2 IMPORT/EXPORT

Available import and export data for mixed, *o*-, *m*-, and *p*-xylene are shown in Table 4-6. From 1991 to 1993 the import of mixed, *o*-, and *p*-xylene to the United States decreased (NTDB 1994). Current data for the import of *m*-xylene are not available. There is no apparent trend regarding the export of xylenes from the United States (NTDB 1994).

TABLE 4-6. U.S. Import and Export Data on Xylenes
(Values = Million Liters)

Year	IMPORT				EXPORT				Reference
	Mixed	<i>o</i> -Xylene	<i>m</i> -Xylene	<i>p</i> -Xylene	Mixed	<i>o</i> -Xylene	<i>m</i> -Xylene	<i>p</i> -Xylene	
1980	NA	NA	NA	NA	NA	NA	287	NA	HSDB 1992
1986	316.8	117.3	3.1	156.7	NA	NA	NA	NA	HSDB 1992
1987	NA	NA	NA	NA	200.6	57	NA	406.8	HSDB 1992
1991	60	10	30	NA	162	49	NA	96.3	NTDB 1994
1992	50	6	3	NA	53	44	NA	157	NTDB 1994
1993	30	5	2	NA	106	53	NA	148	NTDB 1994

NA = Data not available

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4.3 USE

Approximately 70% of mixed xylene is used in the production of ethylbenzene and the *m*-, *o*-, and *p*-isomers. The remaining mixed xylene is used as a solvent, in products such as paints and coatings, or blended into gasoline (Fishbein 1988; HSDB 1992; Riihimaki and Hanninen 1987; Santodonato et al. 1985).

The xylene isomers are used as industrial solvents and serve as intermediates in synthetic reactions. *m*-Xylene is a chemical intermediate in the production of isophthalic acid, *m*-toluic acid, and isophthalonitrile; isophthalic acid, in turn, is used in the manufacture of polyesters. *o*-Xylene is a chemical intermediate in the synthesis of phthalic anhydride (for plasticizers), phthalonitrile, 4,4-(trifluoro-1-(trifluoromethyl)ethylidene), diphthalic anhydride (for polyimide polymers), terephthalic acid (for polyesters), isophthalic acid, vitamins, and pharmaceuticals. *p*-Xylene is a chemical intermediate for the synthesis of dimethyl terephthalate, terephthalic acid (for polyesters), dimethyl tetrachloroterephthalate, vitamins, and pharmaceuticals. Both *o*-xylene and *p*-xylene are used as components of insecticides (Hawley 1981; HSDB 1992).

4.4 DISPOSAL

Various methods of incineration are used in the disposal of xylene isomers, such as fluidized bed rotary kiln and liquid injection incinerator methods (EPA 1981b; HSDB 1992). The addition of a more flammable solvent has been suggested to make the process easier (HSDB 1988).

Criteria for the disposal of xylenes are currently subject to significant revision. Under the Resource Conservation and Recovery Act, waste product, off-specification batches, and spill residues of xylenes greater than 1,000 pounds are subject to handling, reporting, and recordkeeping requirements. This applies also to spent xylene solvents and still bottoms from the refining of these solvents (EPA 1980b, 1981c).